Citation:

Williams P. Breakfast and the diets of Australian children and adolescents: An analysis of data from the 1995 National Nutrition Survey. *Int J Food Sci Nutr*. 2007 May; 58 (3): 201-216.

PubMed ID: 17514538

Study Design:

Cross-sectional study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- To describe the nutrients provided to Australian children and adolescents by the breakfast meal
- To compare the food and nutrient intakes and health of regular breakfast-eaters (those who ate breakfast at least five days per week) and skippers (those who ate breakfast rarely or never).

Inclusion Criteria:

- Australian residents (selected to participate in the National Nutrition Survey)
- Two to 18 year old children and adolescents
- Adolescents aged 15 to 18 were interviewed with their own consent
- Children two to 14 were not interviewed, a parent, guardian or close relative was asked to answer on their behalf.

Exclusion Criteria:

- Age younger than two or older than 18 years old
- Children younger than 15 whose parents were unwilling to participate.

Description of Study Protocol:

Recruitment

- Described elsewhere

- The National Nutrition Survey (NNS) covered a nationally representative sub-sample of the National Health Survey and was conducted in the householders' homes by trained nutritionists
- The survey was conducted from February 1995 to March 1996.

Design

Cross-sectional design.

Dietary Intake/Dietary Assessment Methodology

Data for the NNS were collected in participants' homes by trained nutritionists. Data collected included:

- 24-hour recalls: Indicate intake of food items on the day prior to the interview
- Physical Measurements: Height and weight (for BMI calculation), waist and hip circumference and blood pressure
- Food-Habits Questionnaire: This included the food frequency questionnaire (used to assess the intake of selected food including nutrient supplements over the previous 12 months). In addition, a series of questions was asked including self-reported health status and "how many days per week do you usually have something to eat for breakfast?"

Intervention

No intervention (observational study), but looked at breakfast consumption, categorizing subjects as "eaters" or "non-eaters."

Statistical Analysis

- Nutrient intakes were calculated by staff of the Australian Bureau of Statistics (ABS) using the 24-hour recall data in the Confidential Unit Record File, which includes food intakes for each individual surveyed and individual respondent estimates of portion sizes
- A food composition database developed by the Australia New Zealand Food Authority was used to calculate nutrient intakes (Australia New Zealand Food Authority 1999)
- Nutrient intakes at breakfast are presented as median rather than mean values, because they were not normally distributed
- Sodium intakes were not estimated in the NNS, because of the unreliability of diet records for this purpose
- Foods were categorized using the groupings of the NNS. Throughout the paper, the category 'breakfast cereals' includes both cold ready-to-eat breakfast cereals (RTEC) and hot porridge-type cereals. The broad category 'cereal foods' includes breakfast cereals, breads,

pastries, cakes and biscuits.

- Food and nutrient intakes were compared with recommended dietary intakes (RDI) for use in Australia at the time of the survey (National Health and Medical Research Council 1991) or other dietary target recommendations. The recommended target for dietary fiber per day was based on the 'Age 5 and older' recommendation; for example, 15 g dietary fiber at age 10 years. Dietary fiber is defined in the Australian Food Standards Code as that fraction of the edible part of plants that are resistant to the digestion and absorption in the small intestine, including polysaccharides, oligosaccharides (degree of polymerization less than two) and lignins (Food Standards Australia New Zealand 2002)
- The dietary target of 55% of energy from carbohydrate was taken from the recommendations of the FAO/World Health Organization (WHO) expert consultation on carbohydrates (WHO, 1998). Servings of cereal foods were calculated by dividing the food intake in grams by the standard cereal servings defined by for the Australian Core Food Groups: 30g for bread, 20g for RTEC and 90g for cooked rice, pasta or porridge.
- The statistical significance of differences between breakfast eaters and skippers and between eaters and non-eaters of breakfast cereal were calculated using the Student T-test.

Data Collection Summary:

Timing of Measurements

One-time data collection (24-hour dietary recall).

Dependent Variables

- Energy (kJ)
- Protein (g)
- Fat (g)
- Carbohydrate (g)
- Sugar (g)
- Dietary fiber (g)
- Niacin (mg)
- Thiamin (mg)
- Riboflavin (mg)
- Folate (g)
- Vitamin A (RE)
- Vitamin C (mg)
- Iron (mg)
- Calcium (mg)
- Magnesium (mg)
- Zinc (mg)
- Phosphorous (mg)
- Potassium (mg).

Independent Variables

Breakfast consumption ("eaters" vs. "non-eaters).

Control Variables

None mentioned.

Description of Actual Data Sample:

- *Initial N:* 3,007 subjects (no gender breakdown)
- Attrition *(final N):* 3,007 subjects (one-time data collection)
- *Age:* Two to 18 years old
- *Ethnicity:* Not Stated
- *Other relevant demographics:* Not applicable
- *Anthropometrics:*
  - BMI data gathered for 16-18 year olds only. Although the mean BMI of 16-18 year old breakfast skippers was higher than that of the breakfast eaters, the difference was not statistically significant
  - Researchers also collected waist and hip circumference and blood pressure, but did not report these data
- *Location:* Study included subjects from urban and rural areas in all States and Territories in Australia.

Summary of Results:

Nutrients Provided by Breakfast

- The breakfast meal provided between 12% and 19% of the daily energy intake. For most nutrients the proportions were very similar for males and females, but the breakfast meal contributed a higher proportion of the total energy intake in the younger children compared with those aged 16-18 years, especially for girls
- Breakfast was generally a very nutritious meal. It was low in fat (20-30% energy from fat), high in carbohydrate (50-55% of energy), a significant source of dietary fiber, and rich in micronutrients (contributing more than 25% of the median daily intake for: Thiamin, riboflavin, niacin, vitamin C, calcium and iron
- Breakfast cereals (as consumed with milk and sugar) contributed significantly to the nutrient density of the breakfast meal. They provided approximately 9% and 6% of the total daily energy intake of boys and girls, respectively, but were a good source (more than 25% RDI) of thiamin, riboflavin and iron (for boys only) and a source (more than 10% RDI) of magnesium (boys and girls), calcium and iron (girls only) and niacin and folate (boys only).

Breakfast Skippers vs. Breakfast Eaters

- Children who regularly ate breakfast had better nutrient intakes overall; higher in dietary fiber and richer in almost all vitamins and minerals (especially thiamin, riboflavin, folate, calcium, iron and magnesium, differences not always statistically significant for all ages)
- There were no significant differences in the daily intakes of sugar or fat between breakfast eaters and skippers (except for eight to 11 year olds), with eaters having higher mean daily intakes.

Dietary Goals

- Breakfast eaters met the RDI or dietary target for every nutrient significantly more often than breakfast skippers (especially regarding thiamin, riboflavin, folate, calcium, magnesium and iron).
- For every nutrient (except zinc in boys four to seven years old) a higher proportion of breakfast cereal eaters had daily intakes greater than 70% of the RDI
- Children who were breakfast eaters consumed significantly more servings in the day of core food group cereals than the skippers, and were twice as likely to meet the core food group cereal targets
- Breakfast eaters were more likely to meet the target of more than 55% energy from carbohydrate than skippers
- In the 16-18 year old group, more breakfast eaters met the dietary targets for fiber than the skippers

Health Status

- BMI data was only available for the 16-18 year old children. Mean BMI was higher in the breakfast skippers (BMI=24 kg/m^2) vs. breakfast skippers (22.3 kg/m^2), although this difference was not significant
- 16-18 year old breakfast eaters more often rated their health as “excellent” (25.9% vs. 22.4%) or “very good” (43.9 vs. 38.4%) than the breakfast skippers, although these differences were not significant.

Author Conclusion:

- The average breakfast of Australian children and adolescents in 1995 was high in carbohydrate and dietary fiber, low in fat and rich in vitamins and minerals
- Children who did not eat breakfast regularly were more likely to have diets that were nutritionally inadequate and less likely to meet national dietary targets for cereal and fiber intakes
- The high proportion of older children and adolescents who are now skipping breakfast

regularly is therefore a cause for concern.

Reviewer Comments:

- *The author planned and commissioned this study's analyses, when previously employed as Director of Scientific and Consumer Affairs at Kellogg (Aus) Pty. Ltd. (This is disclosed in paper)*
- *The paper's methodology states that adolescents between the ages 15-18 years were interviewed and measured with their own consent. Later, the paper mentions BMI results of 16-18 year olds, but there is no mention of 15 year olds (even though these data were collected)*
- *Researchers only used 24-hour recall, which may not be indicative of regular food or breakfast consumption*
- *In 1996 Australia changed fortification requirements*
  - *It is likely that the contribution of folate from breakfast cereals is significantly greater now (folate fortification is now permitted and has been adopted in many ready-to-eat breakfast cereals)*
  - *Vitamin A was removed as a fortificant and is now only permitted as an additive in the form of B-carotene (not retinol).*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes

2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes

5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	N/A

	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	No
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes